PORTABLE REAL-TIME HIGH-RESOLUTION DIGITAL PHASE-STEPPING SHEAROGRAPHY WITH INTEGRATED EXCITATION MECHANISMS

ABSTRACT OF THE DISCLOSURE

A portable nondestructive testing instrument uses high-speed phase-stepping shearography, and vacuum stressing, to produce images of disbonds, impact damage, or delaminations, in metal or composite structures. The invention is especially useful in the inspection of large areas where only external access is feasible, such as in large aircraft, space vehicles, boats, or civil engineered structures having multiple bond lines. The invention includes a novel combination of components and techniques, including a high-spatial-resolution CCD sensor, low-voltage piezoceramic phase stepping, rapid phase stepping, a fast phase calculation technique, a fast image smoothing technique, and an implementation of all of the above in a portable unit. Specially designed timing and control algorithms allow data acquisition, transfer, calculation, smoothing, and display at rates of up to two times per second. The invention also includes the above-described combination, in conjunction with three excitation mechanisms provided in an integrated portable package.